

REMARKS

Claims 1-14, 33, 40 and 41 are pending in the present application. In the Office Action dated May 4, 2005, the Examiner rejected claim 14 under 35 U.S.C. 112, first and second paragraphs, as lacking written description support and being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 14 was also rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,399,234 to Yu et al. ("the Yu patent"). The examiner has also rejected claims 1-14, 33, and 40-41 as being based upon a defective reissue oath/declaration under 35 U.S.C. 251.

Interview Summary

Applicant thanks the Examiner for the phone interview on August 2, 2005. In the interview, the Examiner and Applicant discussed the rejections in the current Office Action. As requested by the Examiner, the Applicant has addressed the rejections in more detail below.

Reissue Oath/Declaration

As a preliminary matter, the examiner has rejected claims 1-14, 33, and 40-41 as being based upon a defective reissue oath/declaration under 35 U.S.C. 251. Applicant will follow the guidelines outlined in M.P.E.P. § 1444, and will wait until the present application is in condition for allowance before submitting a cumulative supplemental reissue oath/declaration.

Embodiments Disclosed in the Present Application and the Cited Reference

The embodiments disclosed in the present application will now be discussed in comparison to the cited references. Of course, the discussion of the disclosed embodiments, and the discussion of the differences between the disclosed embodiments and the cited references, does not define the scope or interpretation of any of the claims. Instead, such discussed differences merely help the Examiner appreciate important claim distinctions discussed thereafter.

Embodiments disclosed in the present application are directed to methods for stopping mechanical and chemical-mechanical polishing (CMP) of a substrate at a desired endpoint. In one embodiment, a polishing machine has a platen, a polishing pad positioned on the platen, and a polishing medium located at a planarizing surface of the polishing pad. The

polishing machine also has a substrate carrier that may be positioned over the planarizing surface of the polishing pad, and at least one sensor that monitors a characteristic of a polishing component that is influenced by the type of material being removed from the substrate. In one embodiment, the sensor is a temperature sensor that senses the temperature of the byproducts produced during polishing. For example, the temperature may be sensed using an optical sensor that senses the emission spectrum from the byproducts. (Applicant's specification, Page 8, line 22 through Page 9, line 12). In another embodiment, the characteristic of the byproducts produced during polishing indicative of the material removed from the substrate is the composition of the byproducts. In one embodiment, the composition of the byproducts may be determined using a spectroscopic technique such as infrared spectroscopy which analyzes the emission spectrum of the byproducts. (Applicant's specification, Page 15, lines 19-23). In yet another embodiment, the characteristics of the byproducts produced during polishing indicative of the material removed from the substrate is the color of the byproducts. (Applicant's specification, Page 15, lines 12-16). Accordingly, the polishing process that removes material from the substrate may be stopped when the characteristic of the byproducts indicates that the material being removed from the planarized surface of the substrate is at the desired endpoint of the substrate.

The Examiner has cited the Yu patent. The Yu patent discloses a CMP process in which the characteristics of the polishing slurry used to polish a substrate are determined using acoustic waves. During polishing of the substrate, the chemical composition of the slurry changes during polishing. The density of the slurry changes in proportion to the change in the chemical composition. The density of the slurry is determined by propagating acoustic waves in the slurry and measuring the velocity of such waves in the slurry. The velocity of the acoustic waves are proportional to the density of the slurry. Thus, the Yu patent does not disclose or fairly suggest analyzing an emission spectrum of the polishing slurry or byproducts therein to determine the composition, color, or temperature of the byproducts produced during the polishing of the substrate. In fact, the Yu patent appears to teach away from analyzing an emission spectrum of the byproducts produced during polishing by employing an acoustic technique which does not appear to produce an emission spectrum characteristic of the byproducts and merely analyzes the speed at which an acoustic wave propagates through slurry.

Claims and Rejections

Turning now to the claims, the patentably distinct differences between the cited references and the claim language will be specifically pointed out. Claim 14 recites “[a] method for stopping polishing of a substrate at a desired endpoint, comprising: monitoring a characteristic of a polishing component indicative of material being removed from a planarized surface of the substrate, wherein the polishing component comprises byproducts produced by polishing the substrate and the characteristic is an *emission spectrum of the byproducts*, and wherein monitoring a characteristic comprises *analyzing the emission spectrum*; and stopping removal of material from the substrate when the characteristic of the polishing component that is monitored indicates the material being removed from the planarized surface is at the desired endpoint of the substrate.” (Emphasis Added). As discussed above, the Yu patent does not disclose or fairly suggest monitoring and analyzing an emission spectrum of the byproducts produced by polishing the substrate.

Claim 14 was rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. In particular, the Examiner finds that the limitations “an emission spectrum” in claim 14 are unclear. As known in the art, the term “emission spectrum” generally means a spectrum of radiation released from an excited atom or molecule. Accordingly, claim 14 requires monitoring a characteristic of a polishing component that comprises a byproduct produced by polishing and this characteristic is an emission spectrum of the byproducts. The emission spectrum may include, for example, an emission spectrum produced by the byproduct during infrared spectroscopy or an infrared emission spectrum emitted from the byproducts characteristic of the byproducts temperature.

As understood by the Applicant, claim 14 was also rejected under 35 U.S.C. § 112, first paragraph because the Examiner alleges that the limitations of “an emission spectrum of the byproducts” lacks written description support. “An objective standard for determining compliance with the written description requirement is, ‘does the description clearly allow persons of ordinary skill in the art to recognize that he or she invented what is claimed.’” (M.P.E.P. § 2163.02). The M.P.E.P. also provides that “the subject matter of the claim need not be described literally (i.e., using the same terms or *in haec verba*) in order for the disclosure to satisfy the description requirement.” (M.P.E.P. § 2163.02). The Applicant’s specification

provides that the chemical composition of the byproducts may be determined by infrared spectroscopy. (Applicant's specification, Page 15, lines 19-23). As known in the art, infrared spectroscopy analyzes the emission spectrum produced by a sample that is characteristic of its composition. Additionally, the Applicant's specification discloses that an optical temperature sensor may be employed to detect the temperature of the byproducts. (Applicant's specification, Page 8, line 22 through Page 9, line 12). Thus, the temperature of the byproducts produced during polishing may also be analyzed using an optical temperature sensor that analyzes that infrared emission spectrum that is emitted by the byproducts. Accordingly, the Applicant's specification provides sufficient written description support for monitoring and analyzing the emission spectrum from the byproducts. Namely, the monitoring and analyzing the emission spectrum may be effected, for example, using infrared spectroscopy or optical temperature detection techniques.

All of the claims remaining in the application (claims 1-14, 33, and 40-41) are now clearly allowable. Favorable consideration and a timely Notice of Allowance are earnestly solicited.

Respectfully submitted,

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